the temperature and humidity to be precisely controlled. This is explained further, by the detailed description of the mode of operation of the apparatus of Figure 1. Thus, dry incoming process gas is supplied to the saturator 16, and gas is super-saturated with steam in the saturator 16, to a humidity level greater then that ultimately desired for the gas. Both the flow of the gas through line 12 and steam through line 14 are controlled and metered. The effect of injecting steam into the gas is also to heat the gas to a first pre-set temperature. Typically, on leaving the saturator 16, the gas is supersaturated at the first pre-set temperature of around 90°C, although the gas may be supersaturated at any temperature in the range of 10°C to 120°C.

B1

[0034] As mentioned above, changing demands on the fuel cell stack are accomplished by changing the flow rate for the gas passing through the line 12. If it is desired to change the temperature and/or the humidity of the gas flow then this is achieved by control of the operating conditions of the first and second heat exchangers 22, 44.

B2

[0040] Referring to Figure 7, there is shown a schematic view of a humidification circuit according to a second embodiment. Here, a steam inlet 70 is connected to a steam supply and is provided with a pressure sensor 72, connected to a pressure switch (not shown) for tripping the fuel cell system if the steam supply pressure is too low. The line 70 then passes through a main shut off valve 74 and a trap 76 is provided for draining off any condensation which may have formed. The steam line then passes through a pressure regulator 78 and includes a pressure gauge 88.

B3

[0040a] A reference inlet, e.g. for air, is provided at 86. This inlet 86 is connected through a pressure regulator 84 and a three way valve 80 (with a temperature controller 82) to the pressure regulator 78.

[0042] Thus, the line 90 includes a steam regulator or shut off valve 94 connected to a further regulating valve 96 Valve 96 is a metering valve which controls the flow of steam into the gas lines. The valve 96 is connected to a temperature controller 98 and a back pressure regulator 102.

B4

[0043] A fuel gas is supplied through a line 112. Steam is injected into the fuel gas at an injection port 114. Steam is supplied to injection port 114 through a non-return valve 116. Correspondingly, on the oxidant side, there is a supply line 112a, for example for air, and a steam injection port 114a. A temperature sensor is provided at 100.

[0046] From the second heat exchanger 126, the fuel gas flows to the fuel cell stack indicated at 130. Again, standard sensors can be provided as indicated at 131, immediately before the inlet to the fuel cell.

B5

In the Claims

Please replace claim 1 with the following amended claim.

1. A method of humidifying a process gas stream, the method comprising:

(a) injecting steam into the process gas stream, so as to humidify the process gas stream at a first temperature and so as to provide the process gas stream with excess humidity;

B6

(b) cooling the process gas stream at a second temperature, lower than the first temperature, to cause condensation of excess moisture;

(c) removing excess condensed moisture from the process gas stream;

(d) delivering the process gas stream at a known, third temperature, whereby the absolute humidity level in the process gas stream is determined from the maximum relative humidity at the second temperature; and

(e) supplying the humidified process gas stream at the third temperature to a fuel cell, and maintaining the third temperature of the process gas stream from step (d) at the third temperature, until the process gas stream reaches the inlet of a fuel cell.

Please delete claim 3.

Please amend claim 4 as follows:

4. A method as claimed in claim 2, which includes injecting steam into the gas stream in an amount sufficient to supersaturate the process gas stream.

Please delete claims 10 to 18.

After claim 9, please insert the following new claims 19 –28 cancelled

19. A method as claimed in claim 1, 3 or 4 wherein step (b) comprises passing the process gas stream through a first heat exchanger, and passing a heat transfer fluid through the first heat exchanger to cool the process gas stream to the second temperature, and step (d) comprises passing the process gas stream through a second heat exchanger and passing a second heat transfer fluid through the second heat exchanger to heat the process gas stream to the third temperature.

20. A method as claimed in claim 19, which includes passing the first heat transfer fluid through a first temperature control circuit, including a first heater and a third heat exchanger, for controlling the temperature of the first heat transfer fluid, and passing the second heat transfer fluid through a second temperature control circuit, including a second heater and a fourth heat exchanger, for controlling the temperature of the second heat transfer fluid.

21. A method of humidifying a process gas stream, the method comprising:

(a) humidifying the process gas stream at a first temperature so as to provide the process gas stream with excess humidity;

(b) cooling the process gas stream at a second temperature, lower than the first temperature, to cause condensation of excess moisture;

(c) removing excess condensed moisture from the process gas stream;

(d) delivering the process gas stream at a known, third temperature, whereby the absolute humidity in the process gas stream is determined from the maximum relative humidity at the second temperature;

wherein step (b) includes passing the process gas stream through a first heat exchanger, passing a first heat transfer fluid through the first heat exchanger to cool the process gas stream to the second temperature, and passing the first heat transfer fluid through a first temperature control circuit including at least a third heat exchanger, for controlling the temperature of the first heat transfer fluid.

22. A method as claimed in claim 21, which includes providing, in the first heat transfer circuit, a first heater for heating the first heat transfer fluid.

23. A method as claimed in claim 21, which includes, prior to step (d) heating the process gas stream in a second heat exchanger to the third temperature, whereby the third temperature is greater than the second temperature, and passing a second heat transfer fluid through the second heat exchanger to heat the process gas stream.

24. A method as claimed in claim 23, which includes passing the second heat transfer fluid through a second temperature control circuit including a second heater and a fourth heat exchanger, for controlling the temperature of the second heat transfer fluid.

25. A method as claimed in claim 24, which includes maintaining the third temperature of the process gas stream, by delivering the process gas stream through a supply line and providing a heating element extending along the supply line.

26. A method as claimed in claim 25, which includes determining the relative humidity of the process gas stream at the third temperature solely from measured values of the second and third temperatures, and setting the second and third temperatures, to obtain a desired level of relative humidity in the process gas stream.

27. A method of humidifying a process gas stream, the method comprising:

(a) humidifying the process gas stream at a first temperature so as to provide the process gas stream with excess humidity;

(b) cooling the process gas stream at a second temperature, lower than the first temperature, to cause condensation of excess moisture;

(c) removing excess condensed moisture from the process gas stream; and

(d) delivering the process gas stream at a known, third temperature, whereby the absolute humidity level in the process gas stream is determined from the maximum relative humidity at the second temperature; and

(e) supplying the humidified process gas stream at the third temperature to a fuel cell, and maintaining the third temperature of the process gas stream from step (d) at the third temperature, until the process gas stream reaches the inlet of a fuel cell.

28. A method as claimed in claim 27, wherein step (d) includes heating the process gas stream to a third temperature greater than the second temperature.

In the Drawings

Please find enclosed replacement copies of Figures 1 and 7.